

PHY100S - The Magic of Physics - Class 25

John Archibald Wheeler on his three phases as a physicist: "First I thought that everything was particles. Then I thought that everything was fields. Now I think that everything is information."

Neutrino ^{cont}

Introduced to conserve energy
in radioactive decays. (1930)

Only interact via Weak
(and Gravity)

Exp'tly discovered 1953 (Yawn!)

Mass! used to think = 0

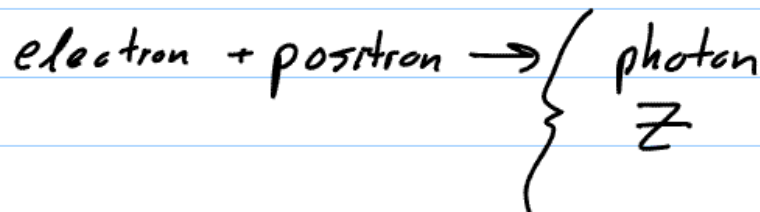
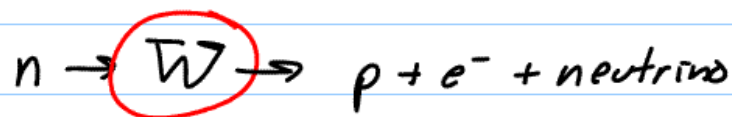
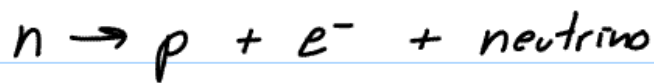
SNO (2002)

mass = (2 - 10) millionths
mass of electron

Quantum Field: quantum exchange
or mediating particle

Electromagnetic: photon

Weak? quantised weak field

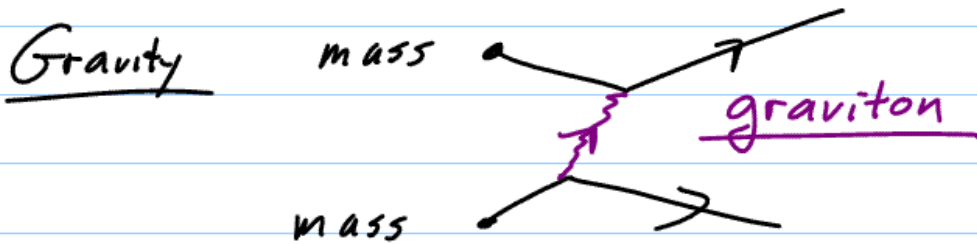


Interactions

electric	} unified 19 th c "electromagnetic"	} unified in 1967 Salam & Weinberg "electroweak"
magnetic		
weak		

Strong binds nucleus together.

Yukawa (1935)



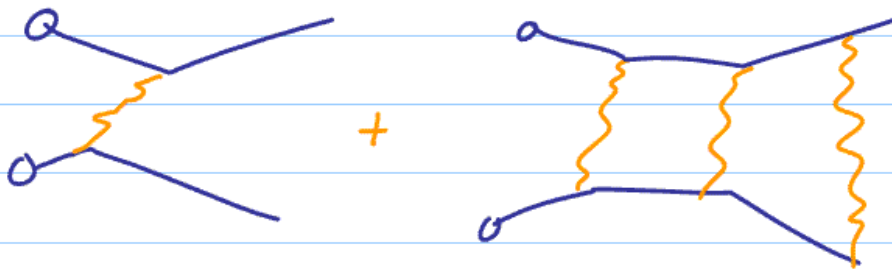
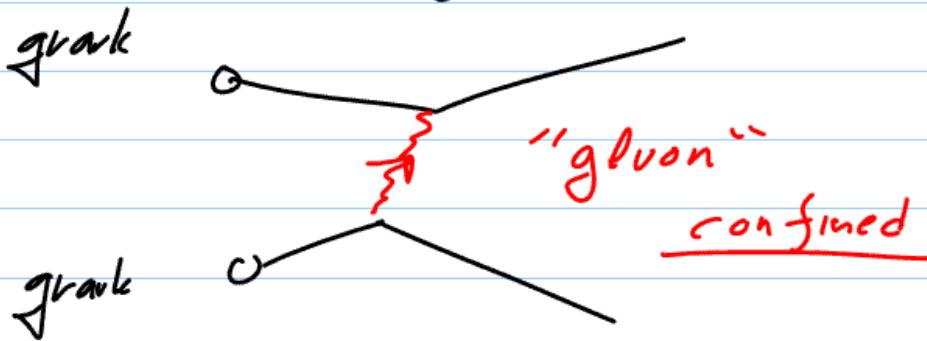
So far - quantised theory of gravity doesn't work.

Like to unify all 4 interactions but we have failed

Unify electroweak & strong!
doesn't work very well.

Gell-Mann (1963):
Zweig: { protons,
neutrons
mesons }

made of quarks
6 kinds



+ all other interactions

STRING THEORY:

no such thing (yet?)

Replace particle zoo with strings

String size \sim size of "quantum foam" -
Planck distance

Vibrate in quantised standing waves.

Each standing wave \Rightarrow
"elementary particle"

11-dimensional

7 are folded up

"compactification"

Time goes up

